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00:00:01,080 --> 00:00:06,080
Hi, my name is Erin Kara, and I’m an

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astrophysicist at NASA’s Goddard Space Flight Center and the University of Maryland.

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I was part of a team who used X-rays to map the environment around a

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recently discovered black hole, learning new details about how those

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surroundings evolve as material swirls closer to the black hole.

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We made the breakthrough using observations from NASA’s

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Neutron Star Interior Composition ExploreR, or NICER, on the

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International Space Station. NICER let us watch a flare

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of light from the area around a black hole called

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MAXI J1820+070, or J1820 for short.

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This stellar-mass black hole is around ten times

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the Sun’s mass, and funnels gas away from a neighboring star

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and into a dense ring of material called an accretion disk.

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Magnetic and gravitational forces compress and heat the gas

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to millions of degrees, hot enough to glow in X-rays.

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We think the flare of X-rays NICER spotted was due to an

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istability in the disk, which caused a flood of material to move toward

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the central black hole. Above the black hole is a region of

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subatomic particles called the corona. The corona is extremely

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hot — 1 billion degrees — and shines in even higher-energy

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X-rays. Not a lot is known about why the corona is so

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hot. This outburst provides an opportunity for us to

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study how both the disk and the corona change as the black hole

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consumes this material. Waves of X-rays from the corona

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echo off the accretion disk like the sonar we use explore the ocean floor.

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These echoes tell us about size and shape of the

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disk and corona. Iron atoms in the disk absorb

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X-rays from the corona and then re-emit them. Gravitational distortion

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of space-time stretches the wavelengths of the X-rays,

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reducing their energy. The farther from the black hole they are, the

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less the light is affected. As we watched the system over weeks,

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the light echoes got closer together. This suggested that

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something in the system was becoming smaller. The low-energy emission

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coming from iron atoms close to the black hole, didn’t change at all,

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suggesting that it was not the disk moving in, but rather the corona

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shrinking. The team and I estimated that the corona

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contracted from roughly 100 miles to only 10.

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The discovery reveals that stellar-mass black holes

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behave similarly to their supermassive cousins, which are

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millions to billions of times the Sun’s mass. Those

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monster objects are found in the hearts of most galaxies, like our Milky Way,

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but their slower evolution over millions or billions of

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years is impossible to detect on human time scales.

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Stellar-mass black holes, on the other hand, evolve much more quickly.

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Thanks to NICER, scientists like me

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are observing the evolution of black hole systems and

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learning more about how our universe works.

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